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Our long-term goal is to develop an efficient, relocatable, infrastructure-free ocean observing system composed of high-endurance, low-cost gliding vehicles with near-global range and modular sensor payload. Particular emphasis is placed on the development of adaptive sampling strategies and the automated control of large glider fleets operating within the framework of an autonomous oceanographic sampling network.

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An Autonomous Glider Network for the Monterey Bay Predictive Skill Experiment / AOSN-II

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LONG-TERM GOALS

Our long-term goal is to develop an efficient, relocatable, infrastructure-free ocean observing system composed of high-endurance, low-cost gliding vehicles with near-global range and modular sensor payload. Particular emphasis is placed on the development of adaptive sampling strategies and the automated control of large glider fleets operating within the framework of an autonomous oceanographic sampling network.

OBJECTIVES

The work proposed is one component of a coordinated effort to demonstrate and quantify gains in predictive skill resulting from model-guided adaptive sampling using a network of autonomous vehicles. During the field experiment the WHOI glider fleet will provide distributed measurements of temperature and salinity, vertically-averaged velocity, and on several vehicles, optical properties including bioluminescence. The specific objectives are to:

1. Construct and operate a fleet of 10 autonomous gliders capable of 30-day continuous operation and Iridium satellite communications.

2. Develop and test, in collaboration with colleagues, the necessary vehicle control protocols to enable model-driven repositioning of the glider fleet during the field experiment.

3. Develop and deploy an integrated optical sensor package incorporating a chlorophyll fluorometer, PAR and turbidity sensors, and a new compact bathyphotometer for bioluminescence measurements

APPROACH

Our primary contribution to this effort will be the construction and operation of the glider network. We will collect and quality-control the glider-based oceanographic measurements and perform basic interpretive analyses in near-real-time. We will take primary responsibility for the post-experiment analysis of the data collected by the gliders and, with our collaborators, synthesize this information with data from other ongoing investigations.

Ten electrically-powered gliders will be constructed to WHOI specifications by Webb Research Corp. over the next six months. All vehicles will be equipped with Iridium communications systems and a Sea-Bird CTD. As each new vehicle is completed and delivered to WHOI it will be subjected to a series of acceptance trials before being incorporated into our ongoing testing program in Buzzards Bay. The number of vehicles chosen for this experiment is sufficient to achieve a nominal horizontal resolution of about 8 km if the vehicles were uniformly distributed throughout Monterey Bay. Such a deployment scenario will obviously not provide optimal resolution of small-scale features but does provide a reasonable approximation of the areal coverage achievable with this number of vehicles. The dimensions of the study area and the initial configuration of the glider fleet will be determined in collaboration with the AOSN-II steering group. Subsequent adaptive reconfiguration of the fleet during the course of the experiment will be directed by predictive modeling results in combination with fleet control algorithms developed by Naomi Leonard (Princeton) and colleagues.

WORK COMPLETED

This program began in summer 2002. We have started the acquisition process for the new vehicles and expect delivery by the end of the year. We are heavily engaged in both scientific and logistical planning for next summer's field program. The preliminary design of the new bioluminescence bathyphotometer (developed in collaboration with Paul Fucile, WHOI) will be tested during October 2002, and made available for intercomparison experiments with other sensors.

IMPACT/APPLICATIONS

Continued development of adaptive multi-vehicle network operations will enable adaptive measurement of time-dependant or transient ocean phenomena such as mesoscale eddies and fronts, as well as generic distributed environmental observations in remote or hostile locations. A network of gliding vehicles will supply, in an efficient and cost-effective manner, high-quality, near-real-time environmental information for operational ocean/atmosphere forecasting and model validation.